OPEN ACCESS Freely available online

ISSN: 1948-5948
Journal of Microbial & Biochemical Technology

Commentary

General Study on Long-term Legacies in Soil Microbial Communities

Nathan Chong*

Department of Biology, University of York, York, UK

DESCRIPTION

The conditions of the soil environment frequently change quickly as a result of discrete, pulsed events that occur over time. These modifications disturb soil microbes and may trigger adaptive responses from the microbial community that could cause it to transition to a new, alternative state. Pulse events, which regularly disturb the soil microbial community at different spatial scales, can be distinctive to the ecological system in which they take place. Changes in temperature, water content, and sudden spikes in carbon and nutrient availability are a few examples that are frequently used. For instance, most terrestrial ecosystems experience soil surface drying and rewetting after rainfall events. A significant portion of the microbiome can be destroyed in temperate forests during the spring freeze-thaw cycle, which can have a significant impact on microbial C and nitrogen cycling. Additionally, for a brief period of time, growing roots release labile C compounds into a volume of soil that is spatially constrained, resulting in hotspots of microbial activity and expansion. Soil microbial communities have been exposed to these pulse events for a very long time because they occur frequently. Each community must therefore be physiologically or genetically adapted to specific types of pulse events in order to demonstrate high resilience communities that recover from perturbations to their initial states.

Furthermore, microbes have characteristics like physiological adaptability, dormancy to survive times of low resource availability, and rapid growth rates that should enable them to recover quickly from perturbations, particularly if they are exposed to them frequently. Extreme short-term changes in microbial activity and community composition can result from abrupt changes in environmental conditions. For instance, repeated freeze-thaw cycles especially at lower frost temperatures, can cause immediate changes in the structure of the microbial community and decrease fungal biomass. The effects of freeze-thawing, however, may not last for very long. For instance, three weeks after four freeze-thaw cycles, it was discovered that the structure and biomass of the microbial community were unaffected. Labile C inputs affect soil microbial communities right away, much like freeze-thaw cycles do. Within hours to days of the addition of labile C, significant changes in the makeup of the microbial community have been seen. A week after a single addition of glucose, there was a noticeable decrease in bacterial diversity, whereas subsequent repeated pulses increased diversity.

The effect of C addition also changes when repeated. Long-term responses longer than a few days or weeks are rarely investigated, despite the fact that most studies analyses the short-term impact on microbial communities. Additionally, multiple pulses or ongoing stressors are frequently used in studies on long-term reactions. These studies look at how communities change in response to repeated pulses, depending on the magnitude, intensity, and frequency of the perturbations.

In contrast, only one pulse perturbation of microbial communities allows for the study of the community's resilience to the single-pulse perturbation, which is influenced by their history of interactions with environmental fluctuations. However, there are few observations and little is known about the long-term response of soil microbial communities to single-pulse perturbations, which represent distinctive changes in their environment. In this study, we sought to understand how soil microbial communities and their stoichiometric environment react to single-pulse environmental changes that frequently occur in the course of natural processes but have different effects on microbial activity and growth. We specifically incubated a soil sample from a temperate beech forest under constant environmental conditions and tracked changes in the soil's environmental C and N stoichiometry, microbial community composition, and biomass over the course of 160 days following a single freeze-thaw event and a single pulse addition of glucose. We also incubated untreated control soil because we anticipated that the soil system would change gradually in a lab incubation experiment in a controlled environment. This allowed us to compare the resilience of perturbed and control soil at the same time.

In order to determine whether microbial communities are resilient to single-pulse perturbations and, if so, how long it would take for them to recover to their pre-perturbation state,

Correspondence to: Nathan Chong, Department of Biology, University of York, York, UK, E-mail: Nathanchong@gmail.com

Received: 02-Feb-2023, Manuscript No. JMBT-23-20148; **Editor assigned:** 06-Feb-2023, Pre QC No. JMBT-23-20148 (PQ); **Reviewed:** 20-Feb-2023, QC No. JMBT-23-20148; **Revised:** 27-Feb-2023, Manuscript No. JMBT-23-20148 (R); **Published:** 06-Mar-2023, DOI: 10.35248/1948-5948.23.15:539

Citation: Chong N (2023) General Study on Long-term Legacies in Soil Microbial Communities. J Microb Biochem Technol.15:539.

our research had two goals. We anticipated that the community would react quickly to disturbances but would ultimately be resilient to them; however, we were unsure of how long it would take for the community to return to its original state. We were able to observe community dynamics after the pulse events in isolation because this experiment explicitly involved a controlled setting of isolated soil microcosms to reduce effects of microbial community dispersion/immigration from unperturbed regions.

CONCLUSION

The results highlighted the intricate coupling of microbial community structure and functions with soil resources. Short-term environmental changes are common and have an impact on microbial biomass and activity in natural soil systems. We draw the conclusion from our observations that pulsed perturbations, which are inherent, recurring features of the environment, can have a significant impact on microbial communities.

It emphasizes the significance of the history of interactions between the soil microbial community and its environment that pulse events, which one might be tempted to refer to as "environmental fluctuations," can sustainably alter community structure and soil C and N pools.

Given that disturbances or changes in the environment frequently take place at small scales in the soil, it is intriguing to consider whether specific soil locations may have their own legacy profiles of earlier disturbances and how this may affect the high biodiversity and localized spatial heterogeneity of soil microbial communities.